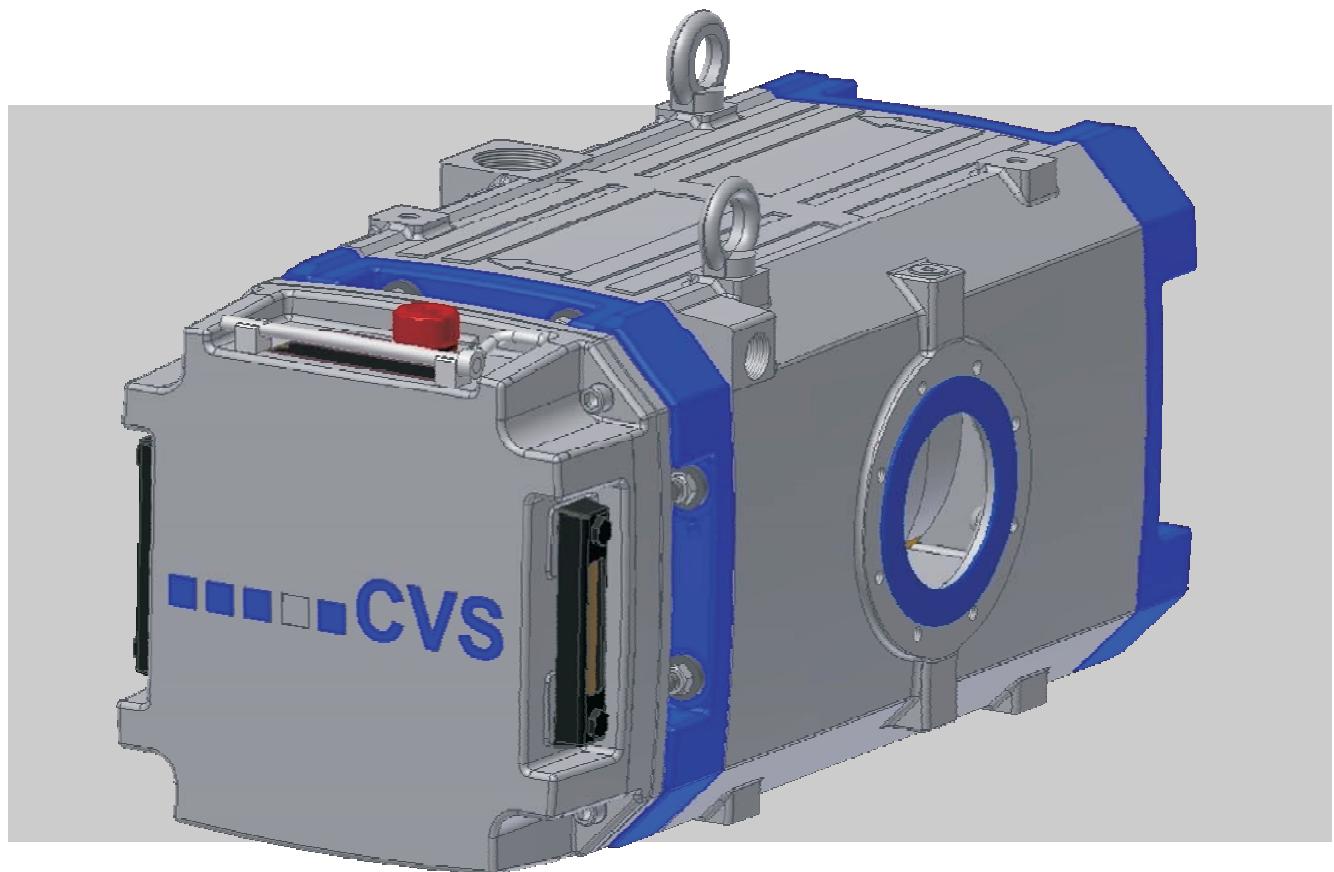




Operating instructions

VacuStar W900 / W1300 / W1600



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The operating instructions must be read by the machine operator and before start-up!

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1 General

1.1 Information regarding the operating instructions

These operating instructions provide important information on how to deal with the machine. Prerequisite for safe working is the observance of all specified safety notes and instructions.

In addition, the local accident prevention regulations valid at the machine's area of application and general safety regulations have to be complied with.

Carefully read the operating instructions before starting any work! They are a product component and must be kept in direct proximity of the machine, well accessible to the personnel at all times.

When passing the machine on to third parties, the operating instructions must also be handed over.

General

1.2 Pictogram explanation

Warning notes

Warning notes are characterised by pictograms in these operating instructions. The warning notes are preluded by signal words expressing the scale of the hazard.

It is absolutely essential to observe the notes and to proceed with caution in order to prevent accidents as well as bodily injuries and property damage.



DANGER!

... points to an immediately dangerous situation, which will lead to death or serious injuries if it is not avoided.



WARNING!

... points to a potentially dangerous situation, which may lead to death or serious injuries if it is not avoided.



ATTENTION!

... points to a potentially dangerous situation, which may lead to minor or light injuries if it is not avoided.



CAUTION!

... points to a potentially dangerous situation, which may lead to property damage if it is not avoided.



Safety note ATEX!

Only for machines with Ex-approval.

This pictogram denotes the special conditions that must be observed according to the approvals when operating the machines in potentially explosive areas.

Hints and recommendations



NOTE!

... highlights useful hints and recommendations as well as information for an efficient and trouble-free operation.

1.3 Limitation of liability

All specifications and notes in these operating instructions were compiled with consideration to the valid standards and regulations, the state of the art as well as to our long-standing knowledge and experience.

The manufacturer is not liable for damages caused by:

- Non-observance of the operating instructions
- Improper use
- Deployment of non-trained personnel
- Arbitrary modifications
- Technical changes
- Use of non-approved spare and wear parts

The actual scope of supply may differ from the explanations and illustrations described in this manual in case of special designs, if additional order options are made use of, or due to latest technical changes.

Incidentally, the responsibilities agreed upon in the delivery contract, the general terms and conditions as well as the manufacturer's conditions of delivery and the statutory provisions valid at the time of contract conclusion shall apply.

Warranty

The manufacturer guarantees the correct functioning of the applied process technology and the performance parameters identified.

The warranty period commences on the date the machine is delivered to the customer.

Wear parts

Wear parts are all components coming into immediate contact with the material to be processed (e.g. bearings, shaft sealing rings, oil pumps, rotor vanes, etc.).

These components are excluded from the warranty and any claims for defects as far as wear and tear damage is concerned.

1.4 Copyright protection

Surrendering the operating instructions to third parties without written permission of the manufacturer is not permitted.



NOTE!

Content details, texts, drawings, pictures and other illustrations are protected by copyright and are subject to industrial property rights. Any improper use shall be liable to prosecution.

Any type and form of duplication – also of extracts – as well as the exploitation and/or communication of the contents are not permitted without the manufacturer's written declaration of consent.

1.5 Spare parts



WARNING!

Risk of injury by incorrect spare parts!

Incorrect or defective spare parts can result in damage, malfunctions or total failure and also impair safety.

Therefore:

- Use only the manufacturer's original spare parts.

Procure spare parts from authorised dealers or directly from the manufacturer. Refer to page 2 for address.

A list of spare and wear parts can be found in the enclosure.

1.6 Warranty conditions

The warranty conditions are included in the sales documentation as separate document.

1.7 Customer service

Our customer service can be contacted for any technical advice. Information about the responsible contact person can be retrieved by telephone, fax, E-mail or via the Internet at any time, refer to manufacturer's address on page 2.

1.8 Manufacturer's declaration

Manufacturer's declaration (pursuant to EC Machinery Directive 98/37/EC, Annex II, refer to enclosure.

2 Safety

2.1 Intended use

The machines of the VacuStar series are exclusively intended for the compression or extraction of filtered air.

The VacuStar in the explosion proof design complies with Directive 94/9/EC (ATEX) and is suitable for conveying potentially explosive gases and gas mixtures of explosion group IIB, temperature class T2/T3 from potentially explosive zone 1 and zone 2 areas. The machine may not be operated in a potentially explosive area.

Machine identification:



II 2G c IIB T2 (i) (for machines without cell ventilation)
II 2G c IIB T3 (i) (for machines with cell ventilation and no potentially explosive external atmosphere).

The gas temperature in temperature class T2 is restricted to 220 °C and in temperature class T3 to 195 °C.

2.2 Proper operation



The following criteria in essence define the proper operation:

- Machine speed range:
1000...1500 rpm
- Ambient temperature: -20...+40 °C
- No coast down of the cooling system after switching off the machine
- Permissible continuous duty vacuum with cell ventilation: 100 mbar
- Permissible continuous duty vacuum without cell ventilation: 200 mbar
- No back pressure on the pressure side during vacuum operation
- Liquids and solids may not get into the machine or be sucked into the machine.



If potentially explosive gases and gas mixtures are conveyed, the following guidelines must be observed:

- 94/9/E6 (ATEX 95), Requirement on equipment
- 99/92/E6 (ATEX 137), Assembly, installation and operation of equipment

Only use machine for the intended use.

All specifications in these operating instructions have to be strictly complied with (technical data, ATEX regulations, etc.)

Any types of claims due to damage arising from improper use are excluded. The operator alone shall be responsible for any damage arising from improper use.

2.3 Acceptance and monitoring

The VacuStar W itself is not subject to any acceptance and monitoring obligation.

2.4 Operator's responsibility

The machine is used for industrial purposes. The operator of the machine is therefore subject to the legal obligations concerning occupational safety.

The provisions valid at the place of installation as well as the safety and accident prevention regulations of the Institution for statutory accident insurance and prevention must be observed. The operator must in particular:

- inform himself on the valid industrial safety regulations.
- determine the additional hazards that arise from the special working conditions at the machine's place of installation by means of a hazard assessment.
- implement the necessary rules of conduct for operation of the machine at the place of installation by means of user instructions.
- check at regular intervals during the machine's entire period of use whether the user instructions correspond to the current state of the body of rules and regulations.
- adapt the operating instructions – if necessary – to the new regulations, standards, and operating conditions.
- clearly regulate the responsibilities for installing, operating, maintaining and cleaning the device.
- ensure that all employees working on or with the machine have read and understood the operating instructions. In addition he must at regular intervals train the employees in how to deal with the machine and inform them about potential hazards.

In addition, it is the operator's responsibility to ensure that:

- the machine is always in a technically perfect condition.
- the machine is maintained in accordance with specified maintenance intervals.
- all safety equipment is regularly checked for completeness and correct functioning.

2.5 Operating personnel

2.5.1 Requirements



WARNING!

Risk of injury in case of inadequate qualification!

Improper handling can lead to considerable bodily injuries and property damage.

Therefore:

- Have any activities only carried out by the individuals designated for that purpose.

The operating instructions specify the following qualification requirements for the different fields of activity:

■ **Instructed persons**

have been instructed during instructions provided by the operator with regard to the work assigned to them and possible hazards arising from improper conduct.

■ **Specialised staff**

is due to its technical training, knowledge and experience as well as due to its knowledge of the pertinent regulations able to carry out the work assigned to it and to independently recognise potential hazards.

2.6 Personal protective equipment

It is necessary to wear personal protective equipment when dealing with the machine so as to minimise health hazards.

- Before carrying out any work, properly don the necessary protective equipment such as gloves, safety goggles, etc. and wear during work.

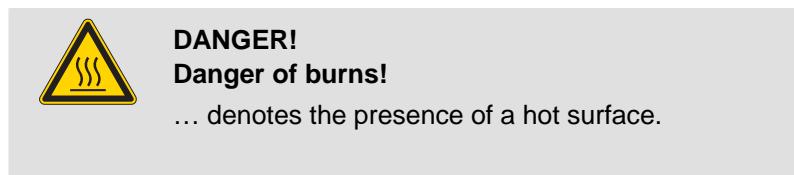
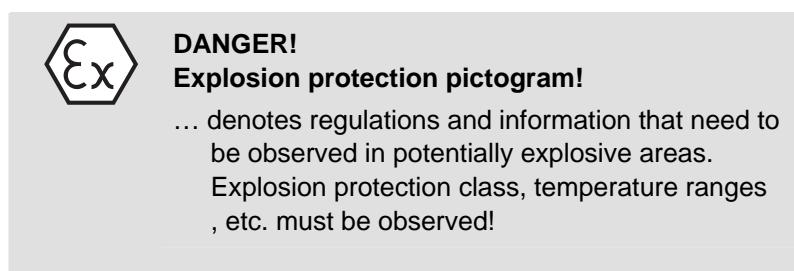
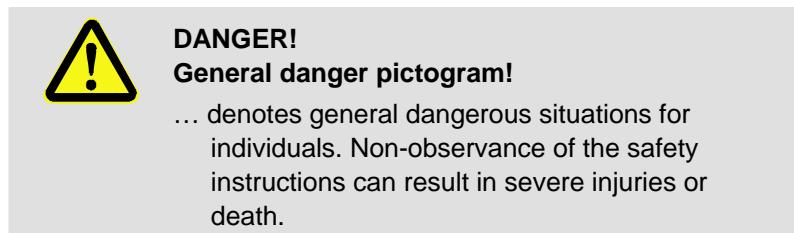
2.7 Occupational safety and special dangers

The remaining risks that result from the hazard analysis are specified in the following section.

Observe the safety notes listed here and the warning notes in the other chapters of these instructions to reduce health hazards and to avoid dangerous situations.

Danger pictograms on the device

The relevant dangerous spots on the machine are identified by these pictograms:



Hazard notes and occupational safety

For your own safety and that of the machine, the following information must be observed and complied with:

Improper operation



DANGER!

Danger due to improper operation!

- Only use machine in a perfect technical condition. Malfunctions that are relevant for safety have to be promptly eliminated.
- Conversions of the machine are not permissible and can impair safety.
- Never bridge any safety equipment or put it out of operation.
- Any work on the machine and/or on electrical equipment must be carried out by specialised staff.
- Repair and maintenance work may only be carried out when the machine is stationary. For this, the machine must be secured against restarting!
- The machine may not be under pressure or in a state of vacuum while work is being carried out on it.
Close shut-off valve on the vehicle side and vent the pipe between machine and shut-off valve or manually relieve excess pressure at safety valve. Observe pressure gauge indication!
- The drive's protective equipment may only be removed when the machine is stationary and has to be correctly refitted after completion of work.
- Only dismantle accidental contact protection after machine and pressure pipe have cooled down.
- It is an environmental protection requirement that any liquids arising during maintenance work (e.g. cooling oil, cooling water, etc.) are collected and disposed of in an environmentally compatible manner
- The machine may only be opened for maintenance and repair work by specialised staff if the machine is stationary and no potentially explosive atmosphere is present.



Moving components**WARNING!****Risk of injury by moving components!**

Powered rotating components can cause the most serious injuries!

Therefore during operation:

- It is absolutely forbidden for individuals to stay in the hazard area or in the immediate vicinity!
- Do not put safety devices and/or functions out of operation and do not render them inoperative or bypass them.
- Never reach into open outlets and inlets or into running equipment.

Before entering the hazard area:

- Switch off power supply and secure against restarting.
- Wait for standstill of lagging components.
- Wait for automatic dissipation and/or discharge of residual energies (compressed air).

Compressed air**WARNING!****Risk of injury due to compressed air!**

Pneumatic energies can cause the most serious injuries.

In the case of damage to individual components, air can be discharged under high pressure and injure e.g. the eyes.

Therefore:

- Before starting any work, first depressurise pressurised components. Pay attention to accumulators. Accumulator pressure must also be completely relieved.
- Do not change pressure settings beyond the maximum values.

Signposting**WARNING!****Risk of injury due to illegible pictograms!**

Labels and signs can become dirty or unrecognisable in the course of time.

Therefore:

- Always keep safety, warning and operating instructions in a well legible condition.
- Immediately replace damaged or obliterated signs or labels.

Improper transport**DANGER!****Danger by falling down or tilting of the machine!**

The weight of the machine may injure a person and cause serious bruising!

Therefore:

- Depending on the dead weight and size of the machine, use a pallet on which the machine can be moved by means of a fork lift.
- For lifting the machine, use suitable lifting gear (slings, etc.) that is designed for the weight of the machine.
- When putting the slings in position, take care to avoid putting stress on individual components.
- Only use attachment points with eye bolts provided for that purpose.

Start-up, operation**WARNING!****Risk of injury due to improper start-up and operation**

Improper start-up and operation can lead to serious bodily injuries or property damage.

Therefore:

- Have all work during initial operation exclusively performed by the manufacturer's employees or by his authorised representatives or by trained personnel.
- Start-up and operation may only be performed by adequately qualified personnel that has been authorised and instructed by the operator.
- Before the start of any work, ensure that all covers and protective devices are correctly installed and function correctly.
- Never override any protective equipment during operation.
- Pay attention to tidiness and cleanliness in the working area! Loosely stacked or scattered components and tools are accident sources.

Electrical system**DANGER!****Mortal danger due to electric current!**

There is mortal danger in case of contact with live components.

Activated, electrically driven components may start to move in an uncontrolled manner, thereby causing the most serious injuries.

Therefore:

- Switch off the electric power supply before commencing any work and secure against restarting.
- Work on the electrical system, on individual electrical components and on the connections may only be carried out by electrical specialists.

Maintenance and trouble shooting**WARNING!****Risk of injury due to improper maintenance and trouble shooting!**

Improper maintenance and trouble shooting can lead to serious bodily injuries or property damage.

Therefore:

- Maintenance work and trouble shooting work may only be carried out by sufficiently qualified and instructed personnel.
- Secure machine against restarting, switch off drives!
- Before starting any work, provide for sufficient space and freedom of movement during assembly.
- Pay attention to tidiness and cleanliness in the assembly area! Loosely stacked or scattered components and tools are accident sources.
- If components must be replaced:
- Pay attention to correct installation of spare parts.
- Properly reassemble all fastening elements.
- Observe screw tightening torques.
- Before restarting, ensure that all covers and protective devices are correctly installed and function correctly.
- After completion of maintenance work and trouble shooting, check correct functioning of safety equipment.

3 Technical data

VacuStar operating data	Unit	Model W900	Model W1300	Model W1600
Nominal operating vacuum	[mbar]	400	400	400
Permissible continuous duty vacuum ¹	[mbar]	100	100	100
Maximum final overpressure during compressor operation in case of direct drive ²	[bar]	2	2	2
Maximum final overpressure during compressor operation in case of V-belt drive ²	[bar]	2	1,5	0,5
Oil reservoir	[l]	7,5	7,5	7,5
Lubricating oil consumption	[l/h]	0,2	0,3	0,4
Weight (without accessories)	[kg]	220	279	339

Table 1: Operating data

Lubricating oils

The use of multigrade oils will damage the VacuStar W. In that case, the warranty on the part of CVS Engineering GmbH shall cease.
 Only single grade oils with the following specification are permitted for operating the VacuStar W:

Specification	Value
API:	CD/SF or higher
MIL:	L2104 C or higher.

Table 2: Lubricating oils

Lubricating oil types

Brand	Suction temperature >10 °C	Suction temperature 10 °C
ARAL	Basic Turboral SAE 40	Basic Turboral SAE 30
AVIA	Cronos Super SAE 40	Special HDC 30
BP	Vanellus C3-40 Energol C-DG 40	Vanellus C3-30 Energol C-DG 30
ESSO	Essolube XD-3 Motor Oil 40 Essolube XD-301 Motor Oil 40	Essolube XD-3 Motor Oil 30 Essolube XD-301 Motor Oil 30
FUCHS	Titan Universal HD 40	Titan Universal HD 30
MOBIL	Delvac 1340	Delvac 1330
SHELL	Rimula X Monograde 40	Rimula X Monograde 30

Table 3: Lubricating oil types

¹ Only in conjunction with cell ventilation, without cell ventilation 200mbar (protection via ventilation valve)

² Protection via a safety valve

4 Design and function

4.1 Design

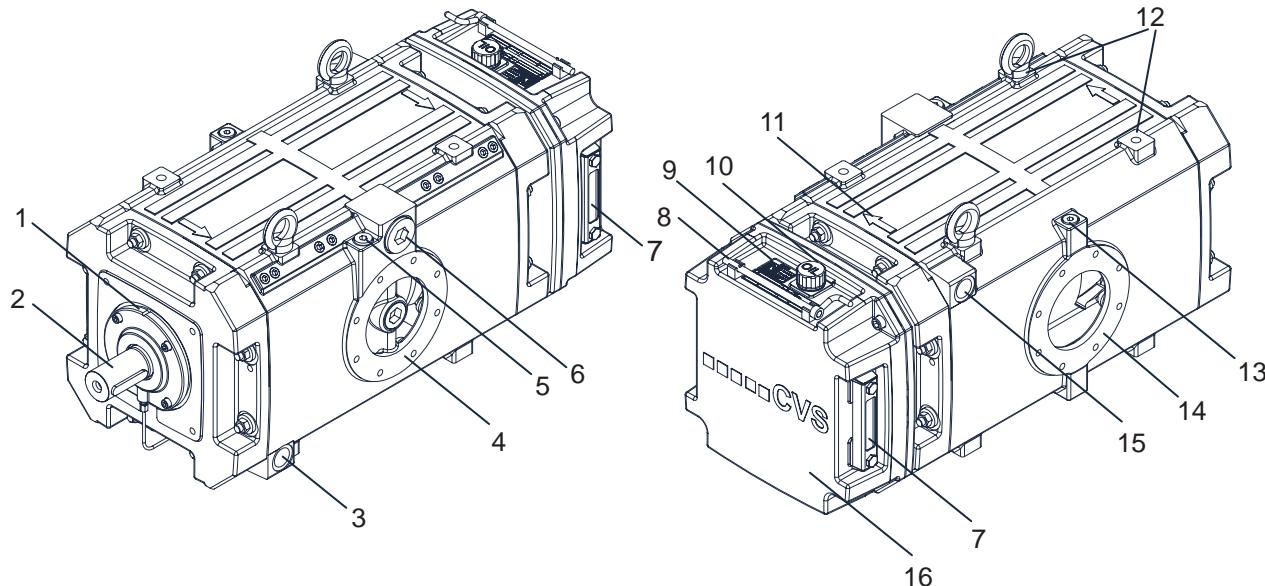


Fig. 1: View VacuStar and details

1	Centring device and fastening of hydraulic motor mounting flange	6	Connection cell ventilation (R 2")	12	Transport and fixing holes (M16)
2	Drive shaft	7	Oil level indicator (bilateral)	13	Negative pressure connection (R 3/8")
3	Cooling water inflow (1")	8	Crank for manual lubrication	14	Suction connection (flange DIN 28459-125)
4	Pressure connection (flange DIN 28459-125)	9	Rating plate	15	Cooling water outflow (R 1")
5	Temperature measuring point (R 1/2")	10	Oil filler neck cap	16	Lubricating oil reservoir
		11	Sense of rotation arrow		

4.2 Function

Functional principle

Sliding vane compressor vacuum pumps work according to the displacement principle.

Due to the rotor's eccentric arrangement inside the casing, limited, crescent-shaped working chambers are created by means of the rotor vanes, which are enlarged or reduced with every turn of the rotor.

Cleaned air is drawn in via the suction connection (item 14) and reaches the pressure line after being compressed via the pressure connection (item 4).

Machine lubrication

The machine is lubricated by means of an oil pump. Oil is pumped from the oil reservoir via the oil lines to the machine's lubricating points.

Cooling

The machine is water-cooled. The machine is equipped with a cooling jacket inside the casing. The cooling water circulates by means of a circulating pump.

Drives

The VacuStar can be powered via:

- Articulated shaft
- V-belt
- Hydraulic motor

Details about the drives and their design can be found in the separate installation instructions for the VacuStar.

4.3 Control and display elements

Depending on the installation situation, different display elements such as pressure gauge, temperature gauge and vacuum gauge are available.

5 Transport and storage

5.1 Safety notes for transport

Refer to chapter 2.7 Safety!

5.2 Transport

The machine, which is fastened on a base plate, must be transported with a fork lift or suitable straps. The lifting gear must be designed for the weight of the machine.

For future transports:

- Seal all open connections with protective caps (prevents penetration of dirt and water)
- Secure loose cables
- Secure against vibrations
- Drain all process and operating media
- Securely fasten the VacuStar prior to transport (e.g. screw it onto a pallet)
- Transport and put down machine with a fork lift or secure with straps and lift with suitable lifting gear.

5.3 Storage

Storage of packages

Store packages under the following conditions:

- Do not store outdoors.
- Store dry and dust free.
- Do not expose to aggressive media.
- Protect against solar irradiation.
- Avoid mechanical vibrations.
- Storage temperature: -10 to +60 °C
- Relative humidity: max. 95%, non-condensing
- If storage lasts longer than 3 months, regularly check the general condition of all parts and of the packaging. If necessary, brush up or recondition the preservation.
- To keep moisture away from the machine's workspace, bags with desiccant must be placed into the inlets and outlets. These must be removed before start-up.

6 Start-up and operation

6.1 Safety during start-up

Refer to chapter 2.7 Safety!

6.2 Start-up

Inspection prior to initial start-up

The following points must be checked prior to initial start-up:

- Fill in **cooling water (clean tap water)** up to the maximum mark on the compensation reservoir.
Add antifreeze according to manufacturer's specifications.
- Top up **lubricating oil** according to lubricating oil schedule.
Fill oil reservoir with oil up to max. 3 cm below filler neck thread.
Manually prelubricate the VacuStar W by means of the crank handle (refer to lubricating oil inspection Chapter 6.4).

Start-up

Proceed as follows during start-up:

- Open shut-off devices (if available)
- Start the VacuStar drive
- Check operating data

Inspections during operation

The following inspections have to be carried out during operation:

- Prior to every start-up and during operation, the oil level and the coolant level must be checked and topped up if necessary.
- Open shut-off devices. Always switch four way cock up to the limit stop, intermediate positions are not permitted
- Switch on drive and check whether pressure or vacuum are created.
- Pay attention to abnormal noises and leaks during operation, if necessary switch off machine.
- Drain condensate at the condensate and safety traps.
Vessel may not be in a state of vacuum when condensate is drained.

Checking the operating data:

- The speed must range between 1000...1500 rpm.
- The cooling water outlet temperature (return flow to radiator) may be max. 60 °C.
- Check positive working pressure at the pressure gauge (permissible pressure refer to rating plate).
- Check the operating vacuum at the vacuum meter (permissible vacuum refer to rating plate).
- The compression end temperature at 20 °C suction temperature may not exceed the following values:
 - 140 °C at 400 mbar operating vacuum
 - 120 °C at 0.5 mbar excess pressure

**Safety note ATEX!**

If potentially explosive gases and gas mixtures are conveyed, the following points must be observed:

- Prior to every machine start and during operation:
 - Check coolant
 - Check oil level
 - Check for leaks
- During the suction process, pay attention to abnormal noises and switch off machine if necessary
- Regularly examine the machine (daily) for signs of overheating and exceptional deformations. If necessary, switch off machine or do not put into operation.
- Regularly examine the machine for leaks such as leaking oil or water or escaping gas. If necessary, switch off machine or do not put into operation.

If the machine is extremely hot: Switch off machine and only switch on again after approximately half an hour, to prevent the rotor from starting.

6.3 Switching off

To switch off the VacuStar, proceed as follows:

- Switch off drive for the VacuStar
- Close shut-off valves (if available)

6.4 Inspections to be performed

Lubricating oil inspection

Only lubricating oils pursuant to the lubricating oil schedule on page 17 are approved for the VacuStar W series.

Check oil level at the inspection glass and if necessary, fill with oil to approx. 3 cm below the filler neck thread. The oil level may not drop below the bottom mark on the oil inspection glass.

Manual prelubrication of the machine is always necessary:

- in case of initial operation
- in case of recommissioning after a standstill of more than 4 weeks
- after sucking over of foreign matter
- after repair work on the VacuStar

Procedure to be followed for manual prelubrication:

- Remove the crank handle from the retaining bracket and push it through the oil filler neck onto the oil pump shaft. Push the crank handle down until the drive dog engages and now prelubricate for approximately 40 full turns.
- Afterwards, clip crank handle back into the retaining bracket and screw locking screw back on again.

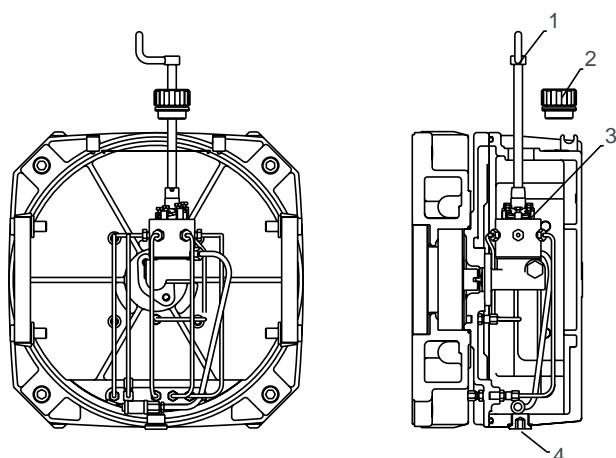


Fig. 2: Oil pump

1	Crank handle	3	Lubricating oil pump
2	Oil filler neck screw	4	Lubricating oil drain screw



The oil reservoir must be filled up before every suction process!

Non-return valve inspection

The non-return valve is maintenance-free, but is subject to wear like all other moving parts. We recommend a visual inspection every 6 months. In this connection, the non-return valve must be dismantled, cleaned, freed of deposits and checked for freedom of motion.

Prior to assembly, the cylinder pin's slide face must be brushed with Loctite No. 8065 lubricant.
Worn out non-return valves must be replaced!

Safety valve inspection

The safety valve is no regulating device!
The operational capability must be checked on start-up and later at weekly intervals.

The safety valve must be secured against misadjustment. Blocking or manipulating the safety valve can have penal consequences if it gives rise to an accident. Any warranty claims shall also be forfeited in such a case.

A maximum pressure pursuant to rating plate is permissible. Depending on the type of drive, this may according to the table Technical data on page 19 be lower.

Inspection of the ventilating valve

As a matter of principle, a ventilating valve must be installed as safety element on the vacuum pump's suction side. When the set vacuum is reached, the ventilating valve opens and admits atmospheric auxiliary air into the system. The operational capability must be checked weekly with the aid of a vacuum meter at the VacuStar's inlet. In case of systems without cell ventilation, the vacuum may not drop below the permissible value of 200 mbar.

In case of systems with cell ventilation, the vacuum may not drop below the permissible value of 100 mbar.

Inspection of cell ventilation

The VacuStar W has been prepared for operation with cell ventilation. The connection is located at the upper part of the pressure flange. If your system's cell ventilation is connected, you may operate the VacuStar up to a vacuum of 100 mbar. A suction filter is located in the cell ventilation line. The filter must be cleaned weekly and replaced in case of visible damage.

7 Maintenance

7.1 Safety during maintenance work

Refer to chapter 2.7 Safety!

Personal protective equipment

The following must be worn during all maintenance work:

- Safety working clothing
- Protective gloves
- Safety shoes
- Safety goggles

Environmental protection

Observe the following information with regard to environmental protection during maintenance:

- Remove emerging, used or excessive grease at all lubricating points that are manually supplied with lubricant and dispose of in accordance with valid local regulations.
- Collect exchanged oil in suitable containers and dispose of in accordance with valid local regulations.

7.2 Maintenance schedule

The following describes the maintenance work that is necessary for an optimum, trouble-free operation. Maintenance intervals must be observed.

If increased wear of individual components or functional groups is determined during regular inspections, the operator has to reduce the required maintenance intervals on the basis of the actual signs of wear.

Changes compared to normal operation (increased power consumption, temperatures, vibrations, noises, etc. or response of monitoring systems) lead to the assumption that the functions are impaired. These then have to be subjected to an inspection by specialised staff.

In case of queries regarding the maintenance work and intervals: contact the manufacturer (service address → page 2).

For maintenance schedule refer to next page.

Maintenance

Table maintenance schedule

Interval	Maintenance work	To be carried out by
Every 15 minutes	Check operating speed Check operating pressure / vacuum Check air outlet temperature Check cooling water return temperature	Operator
Daily	Check condensate Check safety trap Check silencer oil trap Check oil level and top up with fresh oil if necessary Check coolant	Operator
Weekly	Check safety valve Check ventilating valve Clean cooling unit / water cooler Clean compressor / vacuum pump Clean vacuum filter Check V-belt, V-belt tension and re-tension if necessary Clean cell ventilation filter, replace if damaged	Operator
Monthly	Clean oil tank Check fastening screws and tighten if necessary Check shaft sealing rings for tightness (no oil may leak from them)	Operator
Quarterly	Check rotor vanes (wear) Check cell ventilation valve	Specialised staff
Half-yearly	Check non-return valve of stage	Specialised staff
10,000 oh / 3 years	Replace shaft sealing rings	Specialised staff
15,000 oh / 5 years	Replace bearings	Specialised staff

7.3 Performance of maintenance work

Cleaning the VacuStar

Carrying out cleaning work:

1. Switch off system and secure against restarting.
2. Remove soiling appropriately. Observe the following:
 - Do not use aggressive cleaning agents.
 - Pay attention during cleaning that no water gets into the compression chamber.
 - Exercise special caution when cleaning with high-pressure cleaning systems.
 - Absorb oil deposits with oil-absorbing materials (e.g. sawdust).
 - After cleaning work, check that all previously opened covers and safety equipment are correctly installed and function correctly.
 - After wet cleaning, warm up the machine for a few minutes.

Water cooling system /cleaning the radiator

Check cooling water level in compensation reservoir and top up if necessary.

Clean radiator in case of soiling as the cooling air must have free passage.

Action after lengthy standstill

If the standstill of the VacuStar installed inside the vehicle lasts for more than a month, we recommend putting the machine into operation once a month for 15 minutes. The machine must be prelubricated prior to start-up (refer to chapter lubricating oil inspection, chapter 6.4.)

Action after sucking over of foreign matter

If foreign matter has been sucked over into the machine, proceed as follows:

- Unscrew locking screw in inlet or dismantle fitted additional lubrication line.
- Open vehicle box to allow the VacuStar to be run without vacuum or pressure build-up.
- Switch on machine and allow approx. 0.5...1 l of a diesel-oil mixture (1:1 mixing ratio) to be sucked into the machine through the hole in the inlet at approx. 1000 rpm.
- Afterwards, allow another 0.5 - 1 l clean oil to be sucked in via the inlet.
- Completely remove this diesel-oil-mixture from the machine and do not allow to collect in the downstream silencer - fire hazard!
- Switch off machine and re-attach locking screw. Prelubricate VacuStar pursuant to chapter Lubricating oil inspection, chapter 6.4 before the machine is restarted.

Cleaning the suction filter

Clean the suction filter depending on accumulated dirt and specification in the maintenance schedule. To open the suction filter 1600 F (fine filter) and 1600 G (coarse filter), it is necessary to open a star handle, on the suction filter 1600 F-D (fine filter, pressure-resistant) and 1600 G-D (coarse filter, pressure-resistant), 5 star handles need to be opened to remove the lid. The hexagon nut on the stud bolt must be unscrewed to remove the filter cartridge.



NOTE!

Pay attention during cleaning that no liquid, dirt or other objects get into the vacuum pump.

Cleaning procedure:

- Rinse out filter casing with detergent.
- Rinse out stainless steel fabric filter cartridge with detergent.
- Carefully rinse out filter cartridge with fine filter cartridge. Check for damage after cleaning. A damaged cartridge must be replaced.
- Check round sealing ring on casing lid for damage. Damaged sealing rings must be replaced.
- After cleaning, reassemble the filter in reverse order.

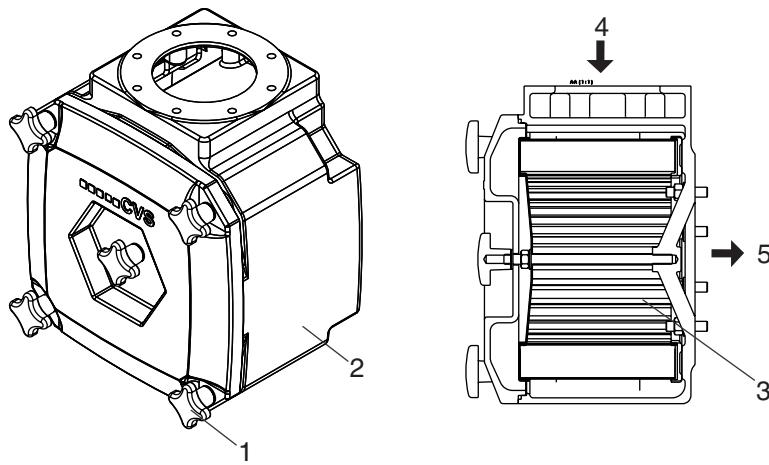


Fig. 3: Suction filter

1	Star handle	4	Air inlet soiled air
2	Casing	5	Air outlet filtered air
3	Filter cartridge		

Check rotor vane's height wear

Carry out the first inspection either after 6 months or after 500 operating hours, depending on which occurs first. The following inspection has to be scheduled according to the measuring result.



NOTE!

Pay attention during the inspection that no liquid, dirt or other objects get into the vacuum pump.

Procedure:

- Dismantle vacuum filter and if necessary suction line.
- Press rotor vanes into the rotor slit in horizontal position and measure the distance to the rotor surface with the depth gauge.
- The wear measurement of 6 mm may not be exceeded. Replace rotor vane if necessary.

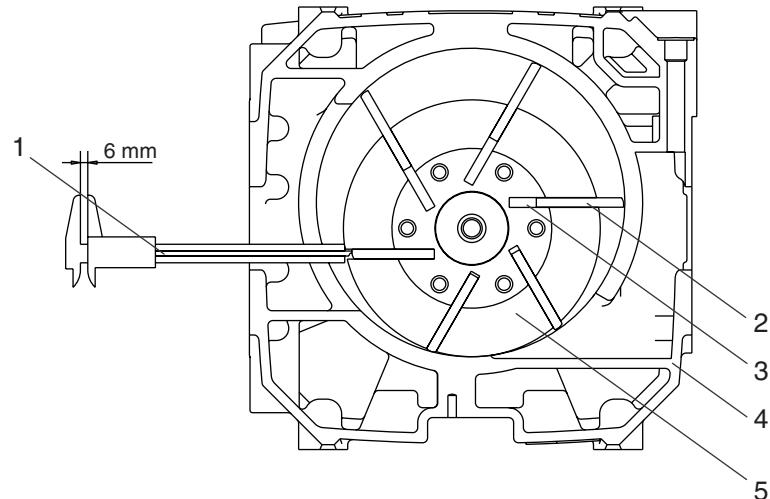


Fig. 4: Cross-section through the VacuStar

1	Depth gauge (max. 6 mm)	4	Casing
2	Rotor vane (6x)	5	Rotor
3	Rotor slit (6x)		

8 Malfunctions

This chapter describes possible causes of malfunctions and trouble shooting tasks.

Reduce the maintenance intervals if similar malfunctions occur repeatedly due to above-average intensive use so intervals correspond to the actual load.

Contact the manufacturer in case of malfunctions that cannot be repaired with the aid of the following information (→ page 2)!

8.1 Safety

Refer to chapter 2.7 Safety!

Personnel

- The trouble shooting work described at this point can be carried out by the operator, unless otherwise indicated.
- Some work may only be carried out by specially trained specialised staff or exclusively by the manufacturer himself. This is specifically pointed out in the description of the individual malfunctions.
- Only electrical specialists may carry out work on the electrical system.
- Components and parts may only be replaced by specialised staff.

Personal protective equipment

Refer to chapter 7.1.

Environmental protection

Refer to chapter 7.1.

Conduct in the case of malfunctions

The following basically applies:

1. Immediately trigger an emergency-stop in case of malfunctions constituting an immediate danger for individuals or material assets.
2. Switch off all power supplies and secure against restarting.
3. Inform person in charge at the place of installation.
4. Depending on the type of malfunction, have the cause determined and eliminated by responsible and authorised specialised personnel.

8.2 Recommissioning after corrective action

After corrective action or trouble shooting:

1. Reset emergency stops.
2. Acknowledge error message or malfunction at the control system.
3. Ensure that nobody is staying in the hazard area.
4. Start in accordance with the instructions in chapter „start-up“.

8.3 Malfunction table

Malfunction:	Possible cause	Corrective action	Execution
Compressor's / vacuum pump's delivery rate decreases	Vacuum filter soiled	Clean vacuum filter	Operator
	Leaky suction line / fittings	Look for leaky spots and eliminate leak	Specialised staff
	Speed too low	Adjust speed	Operator
	Wear of rotor vanes, possibly caused by dirt or liquids that have gotten into the machine (sucking over of foreign matter)	Replace rotor vane, remove dirt and have machine overhauled at an authorised workshop	Specialised staff
Abnormal noise emission	Machine is out of alignment	Align machine accurately	Specialised staff
	Bearing defective	Replace bearing (or have it replaced)	
	Lack of lubricating oil	Top up oil, clean oil reservoir and suction filter	Operator
	Unsuitable lubricating oil	Fill in oil according to lubrication schedule	Operator
	Rotor vanes are jammed	Check rotor vanes	Specialised staff
	Casing bore shows grooves or corrugations due to the aspiration of dirt	Have casing bore re-turned and honed at an authorised workshop. In case of heavily soiled intake air, install fine filter	Specialised staff
	Wrong speed	Maintain speed range	Operator
	Changed pressure	Maintain nominal pressure	Operator
	Changed vacuum	Maintain nominal vacuum, check exhaust system and clean if necessary	Operator
	Non-return valve rattles	Check non-return valve	Specialised staff
Compressed air temperature too high	Foreign matter in the machine	Remove foreign matter. Rinse out machine.	Specialised staff
	Slide breakage	Immediately switch off machine and repair	Specialised staff
	End pressure too high	Maintain nominal pressure	Operator
	Exhaust silencer clogged	Replace exhaust silencer	Specialised staff
	Four way cock in wrong position	Correctly adjust four way cock	Operator
	Poor cooling	Replenish cooling water, clean radiator, clean cooling water chamber inside the machine	Operator
	Valve plate in non-return valve is jammed	Check non-return valve and clean if necessary	Specialised staff
	Vacuum filter clogged	Clean vacuum filter	Operator
	Vacuum too high	Maintain nominal vacuum	Operator

Malfunctions

Malfunction:	Possible cause	Corrective action	Execution
Operating pressure or operating vacuum is not obtained	Pressure gauge or vacuum meter do not indicate correctly	Replace pressure gauge or vacuum meter	Specialised staff
	V-belts are slipping	Check V-belt tension and re-tension if necessary	Operator
	Four way cock in wrong position	Correctly adjust four way cock	Operator
	Condensate drain cock open	Close condensate drain cock	Operator
Cooling water temperature exceeds 60°C	Too little cooling water in cooling system	Top up cooling water	Operator
	Radiator soiled or compressor cooling water chambers silty	Clean radiator, clean cooling water chambers on compressor	Operator
Silt or liquid has gotten into the machine	Foreign matter has been sucked over into the machine	Rinse thoroughly with diesel-oil-mixture at lowest permissible speed and without pressure or vacuum, afterwards add lubricating oil according to chapter Lubricating oil inspection page 30.	Operator
Power requirement too high	Speed too high	Maintain speed limit	Operator
	End pressure too high	Maintain nominal pressure, actuate / check safety valve	Operator
	Pressure gauge indicates incorrectly	Replace pressure gauge	Operator
	Exhaust silencer clogged	Replace exhaust silencer	Specialised staff
Lack of lubricating oil despite full oil tank	Oil intake strainer in oil tank clogged	Clean oil tank and intake strainer, check oil lines	Operator
Safety valve blows off	Closed valves in the pressure line	Open valves	Operator
	Clogging in pressure system	Eliminate clogging	Operator
	Exhaust silencer clogged	Replace exhaust silencer	Specialised staff
Ventilating valve responds	Closed valves in the suction line	Open valves	Operator
	Suction filter clogged	Clean suction filter, if necessary replace filter cartridge	Operator
Compressed air blows off at shaft end and oil is leaking	Sealing parts are damaged	Replace radial shaft sealing rings in sealing cover	Specialised staff
Rubber smell (at V-belt drive)	V-belts slip due to too insufficient belt tension	Check belt tension, re-tension if necessary	Operator
	End pressure too high	Maintain nominal pressure	Operator
Reversing of V-belts	Insufficient belt tension	Check belt tension, re-tension if necessary	Operator
	Worn V-belts	Put on new V-belts	Operator
	Pulleys are not aligned	Align pulleys	Specialised staff
	Worn V-belt pulleys	Replace pulleys	Specialised staff

9 Spare parts

We recommend stocking a service package as well as a suction filter cartridge.

The service package comprises all wear parts that are required for a normal repair.

Customer service

In case of queries regarding the product, spare part orders, repairs, replacement machines and dispatch of fitters, please contact our customer service: Phone.: +49 (0) 7623 71741-31

Spare and wear parts	Model	Service package	Filter cartridge
	VacuStar W900	900 000-SP	
	VacuStar W1300	990 001-SP	
	VacuStar W1600	990 002-SP	
	Suction filter 1600 F		432 020-00
	Suction filter 1600 G		432 021-00

10 Decommissioning and disposal

A VacuStar unit that is no longer usable should not be recycled as complete unit, but disassembled into individual components and recycled according to material types. Non-recyclable materials have to be disposed of in an environmentally compatible manner.

- Prior to decommissioning and disposal of the machine, it must be completely separated from the surrounding units.
- The disassembly and disposal of the machine may only be carried out by specialised staff.
- If hazardous or poisonous material were conveyed, the machine must be decontaminated prior to disposal.
- The machine has to be disposed of in accordance with the respective country-specific regulations.

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